

LAKE HARTWELL PCB STUDY

Site:	
Break:	1, 2
Other:	

During the period August 11-26, 1976, personnel from the Surveillance and Analysis Division collected and/or analyzed samples from Lake Hartwell and contiguous suspect areas for PCBs. The sampling/analyses program consisted of:

- o Fish sampling in Lake Hartwell;
- o Sediment sampling in Lake Hartwell, Twelve Mile Creek, Middle Fork Twelve Mile Creek, North Fork Twelve Mile Creek, Wolf Creek, and Golden Creek;
- o Soil samples and upstream-downstream sediment and/or water samples from Trotters Dump, Midway Dump, and Easley Landfill;
- o Influent and effluent sampling at the wastewater treatment facilities serving Pickens, Clemson, and Clemson University;
- o Extensive water and sediment sampling of Sangamo Electric Company, and
- o Raw and/or finished drinking water at Anderson, Pendleton, Easley, Pickens, Hartwell, J.P. Stevens, DeFore Mills, and Riegel Textiles (samples collected by Water Supply Branch)

SYNOPSIS OF RESULTS

- o Fish - results previously submitted by memorandum dated August 20, 1976.
- o Sediment Samples - (Table 1 and Figures II and III). The largest quantity of PCBs observed in sediments were immediately downstream from Sangamo Electric Company. Station L-18 (in Lake Hartwell) contained 19.0 mg/Kg. The concentration of PCBs in the sediments generally decreased in a downstream direction. Of the 20 sediment stations in Lake Hartwell, 15 contained measurable quantities of PCBs. PCBs were not observed in the Savannah River arm of Lake Hartwell. PCBs were also observed in the sediments upstream from the Easley Landfill and Trotters Dump. PCBs were also measured in the sediments of Twelve Mile Creek, North Fork Twelve Mile Creek, Middle Fork Twelve Mile Creek, Town Creek, and Golden Creek. PCBs were not observed in Wolf Creek.
- o Ambient Waters - (Table 2 and Figure III). PCBs were observed in the ambient waters in Town Creek, downstream from Sangamo Electric Company, at Stations L-41 and L-42 at 2.02 and 1.69 µg/l, respectively.



- o Landfills/Dumps - (Table 3 and Figure III). The Trotter's Dump samples contained 96 and 130 mg/Kg PCBs, while the Easley Landfill samples contained 1.2 and 1.4 mg/Kg PCBs. No PCBs were detected in the soil samples from the Midway Dump.

A small garden was located on the Trotter's Dump. Significant concentrations of PCBs were measured in bell peppers, peas, and potatoes (Table 7).

- o Sangamo Electric Company - (Table 4 and Figure I). During the initial two day composite sampling program, (8/24-26/76) Sangamo discharged 10.5 µg/l (0.101 pounds/day) and 8.84 µg/l (0.085 pounds/day) PCBs into Town Creek. Approximately 90% of the PCBs were identified as Aroclor 1016 and 10% as Aroclor 1254. The influent into the upper pond and lower pond contained an average of 54 µg/l and 18 µg/l, respectively. Additional sampling of the effluent was conducted during the period September 1-3, 1976. During this two day sampling period, PCBs in the effluent increased to 20.9 µg/l (0.200 pounds/day) and 33.3 µg/l (0.319 pounds/day).

Sediment concentrations of PCB in the lower pond were higher than the upper pond, i.e., approximately 27,300 mg/kg (six samples) and 7970 mg/kg (six samples), respectively. The septic tank effluent to the drain tile field contained an average of 958 µg/l PCBs.

- o Waste Treatment Plants - (Table 5 and Figures II and III). The highest concentrations of PCBs were observed in the Wolf Creek STP influent at 29 µg/l. The influent to the STP's at Clemson and Clemson University also contained PCBs at concentrations of 5.1 µg/l and 0.99 µg/l (two samples), respectively. The influent into the Town Creek STP did not contain PCBs. No PCBs were observed in the effluent from any of the STPs.
- o Water Treatment Plants - (Table 6). Concentrations of PCBs in the raw and finished drinking water at all facilities were either non-detectable or were <0.1 µg/l.

CONCLUSIONS

- o Sangamo Electric Company is the major contributor of PCBs into Town Creek, Twelve Mile Creek, and Lake Hartwell.
- o The concentration of PCBs in Sangamo Electric Company's effluent increased significantly with the bypassing of the upper pond, i.e. from an average of 9.7 µg/l to 27.1 µg/l.

- o Sediments in Town Creek downstream from Sangamo Electric Company, Twelve Mile Creek downstream from confluence of Town Creek, and the Seneca River arm of Lake Hartwell are contaminated with PCBs. The Middle Fork Twelve Mile Creek, North Fork Twelve Mile Creek, Town Creek upstream from Sangamo Electric Company, Golden Creek, and other portions of Lake Hartwell also contain PCBs in the sediments.
- o These dry weather data indicate that Trotters Dump, Midway Dump, and Easley Landfill are not presently contributing PCBs into the river system. However, PCBs in Trotters Dump debris, and to a lesser extent, the Easley Landfill debris are respositories and may be a source of PCBs into the ambient waters during moderate and heavy rainfall.
- o As observed from Table 7, vegetables do uptake PCBs and could represent a potential health problem if harvested in areas containing PCBs in the soil.
- o Sludge in Sangamo Electric Company ponds are highly contaminated with PCBs with concentrations in the lower pond ranging from 129 mg/Kg to 77,200 mg/Kg and in the upper pond ranging from 21.9 mg/Kg to 45,300 mg/Kg.
- o Sangamo Electric Company is in violation of their NPDES permit by discharging approximately 30 µg/l PCBs into Town Creek.
- o Data indicate that Sangamo Electric Company domestic and laundry wastes contain PCBs. The influent to the drain tile field contained an average of 958 µg/l PCBs.
- o The influent to the Pickens Wolf Creek, Clemson, and Clemson University STP's are contaminated with PCBs. However, the treatment systems are effectively removing PCBs from the water column.

RECOMMENDATIONS

- o The Sangamo Electric Company waste treatment system should be thoroughly evaluated in order to determine the best means of alleviating PCBs from the discharge. Based upon the initial study, serious considerations should be given to abandonment of the present system. A new system, to insure the removal of PCBs, should be designed and constructed.

- o Additional sampling and evaluation of the Sangamo Electric Company's domestic and laundry wastes should be conducted in order to determine the source of PCBs and potential exposure of employees to PCBs.
- o A long term monitoring program should be immediately instituted in order to advise the population of the potential health hazard. Such a program should include, as a minimum, the following:

1. Fish - The fish monitoring program will be directed primarily at the important species of the sport and commercial fisheries. These species include Crappie, Largemouth Bass, White Bass, Striped Bass, and Catfish. The Tugaloo River, Seneca River, and the main body of the lake (mid and dam reach) are the planned sampling area. Frequency of sampling is initially set at six week intervals.

At least three specimens representing a given species will be processed for PCB analysis. In each case, a composite sample will be prepared from one filet from each specimen. If the composite yields 1.67 mg/Kg or less, it will be assumed that no individual fish contains more than the FDA recommended level of 5 mg/Kg. If the composite yields 5 mg/Kg or more, it will be assumed that all in the composite sample contain excessive levels. If the composite yields between 1.67 mg/Kg to 4.99 mg/Kg, the individual filets will be analyzed for identification of possible excessive levels. In this manner, the composite analyses serves as a screening test for concerning levels of PCBs. The second step allows for correlating PCB concentrations to specific data regarding size and weight of the original specimen

2. Daily composite sampling of the Sangamo Electric Company influent and effluent by Sangamo Electric Company. Bi-monthly sampling of influent and effluent by EPA.
3. Monthly sampling of ambient waters immediately downstream from Sangamo Electric Company, Twelve Mile Creek downstream from Town Creek, and Twelve Mile Creek at EPA Station L-18.
4. Semi-annual sediment sampling at EPA Station L-41, L-42, L-25, L-18, L-14, L-8, L-7, and L-5.

5. Semi-annual sampling of influent, effluent, and sludge at Pickens, Clemson, and Clemson University STP's.
6. Semi-annual sampling of landfill/dump debris and leachate.
 - o The Pickens, Clemson, and Clemson University STPs and sewerage systems should be further evaluated to determine sources and ultimate fate of PCBs.
 - o Other potential sources of PCBs should be investigated, i.e., Anderson STP; Singer Company in Anderson; leachate from dump and landfills during wet weather conditions, possible sources upstream from Easley Landfill and Trotters Dump, and possible sources on Tugaloo River, Keowee River, and other tributary streams to Lake Hartwell with PCBs in the sediments.

Acknowledgements

Appreciation is extended to the many state agencies in South Carolina, Georgia, and Alabama which assisted in the various field aspects of this study.

TABLE 1
LAKE HARTWELL PCB SAMPLING
STREAM/LAKE SEDIMENTS

EPA Sta #	Location	Date Sampled	Aroclor 1016 (mg/kg)**	Aroclor 1254 (mg/kg)**	Total PCB's (mg/kg)**
L-01 *	Lake Hartwell	8/24/76	ND	ND	ND
L-03	Lake Hartwell	8/24/76	ND	ND	ND
L-04	Lake Hartwell	8/24/76	ND	ND	ND
L-05	Lake Hartwell (Tugaloo River)	8/24/76	0.01	0.01	0.02
L-06	Lake Hartwell (Tugaloo River)	8/24/76	0.61	ND	0.61
L-07	Lake Hartwell (Seneca River)	8/24/76	0.26	0.61	0.87
L-08	Lake Hartwell (Seneca River)	8/24/76	2.22	1.02	3.24
L-09	Lake Hartwell	8/24/76	ND	2.64	2.64
L-10	Lake Hartwell	8/24/76	ND	ND	ND
L-11	Lake Hartwell (Seneca River)	8/24/76	0.17	0.06	0.23
L-12	Lake Hartwell	8/24/76	ND	ND	ND
L-13	Lake Hartwell	8/24/76	0.45	0.20	0.65
L-14	Lake Hartwell (Seneca River)	8/24/76	3.12	3.47	6.59
L-15	Lake Hartwell (Seneca River)	8/24/76	2.6	0.86	3.46
L-16	Lake Hartwell (Seneca River)	8/24/76	2.99	2.85	5.84
L-17	Lake Hartwell (Keowee River)	8/24/76	0.84	0.01	0.85
L-18	Lake Hartwell (12-Mile Creek)	8/24/76	13.90	4.86	18.76

TABLE 1
(Continued)

EPA Sta #	Location	Date Sampled	Aroclor 1016 (mg/kg)**	Aroclor 1254 (mg/kg)**	Total PCB's (mg/kg)**
L-19	Lake Hartwell (12-Mile Creek)	8/25/76	0.32	0.41	0.73
L-20	Lake Hartwell (12-Mile Creek)	8/25/76	1.66	2.34	4.00
L-21	12-Mile Creek	8/25/76	ND	0.09	0.09
L-22	12-Mile Creek	8/25/76	0.27	0.26	0.53
L-23	12-Mile Creek	8/25/76	ND	0.05	0.05
L-24	12-Mile Creek	8/25/76	0.08	0.18	0.26
L-25	12-Mile Creek	8/25/76	2.38	1.09	3.47
L-26	North Fork 12-Mile Creek	8/25/76	0.01	0.02	0.03
L-27	Middle Fork 12-Mile Creek	8/25/76	ND	ND	ND
L-40	Town Creek	8/25/76	18.39	3.69	22.08
L-43	Town Creek	8/25/76	2.71	0.63	3.34
L-44	Town Creek	8/25/76	0.08	0.02	0.10
L-46	Town Creek	8/25/76	ND	ND	ND
L-48	Wolf Creek	8/25/76	ND	ND	ND
L-51	Wolf Creek	8/25/76	ND	ND	ND
MF-1	Middle Fork 12-Mile Creek	8/24/76	0.23	ND	0.23
MF-2	Middle Fork	8/24/76	ND	ND	ND
*L-02	Lake Hartwell	8/24/76	ND	ND	ND

** Calculated on a dry weight basis

TABLE 2
LAKE HARTWELL PCB SAMPLING
AMBIENT WATERS

EPA Sta #	Location	Date Sampled	Aroclor 1016 (µg/l)	Aroclor 1254 (µg/l)	Total PCB's (µg/l)
L-47	Town Creek (upstream from Singer)	8/25	<0.06	ND	<0.06
L-45	Town Creek (upstream from Sangamo)	8/25	<0.20	<0.20	<0.20
L-41	Town Creek (downstream from Sangamo)	8/25	1.6	0.42	2.02
L-42	Town Creek (downstream from Sangamo)	8/25	1.3	0.39	1.69
L-50	Wolf Creek	8/25	ND	ND	ND
L-49	Wolf Creek	8/25	ND	ND	ND
MF-1	Middle Fork 12 Mile Creek (upstream from Trotters Dump)	8/24	ND	ND	ND
MF-2	Middle Fork 12 Mile Creek (downstream from Trotters Dump)	8/24	ND	ND	ND
GC-2	North Fork 12 Mile Creek (upstream from Midway Dump)	8/24	ND	ND	ND
GC-1	North Fork 12 Mile Creek (downstream from Midway Dump)	8/24	ND	ND	ND
GC-2	Golden Creek (upstream from Easley Landfill)	8/24	ND	ND	ND
GC-1	Golden Creek (downstream from Easley Landfill)	8/24	ND	ND	ND
-	Trotters Dump Pond Water	8/24	0.17	0.24	0.41

TABLE 3
LAKE HARTWELL PCB SAMPLING
LANDFILL/DUMPS DEBRIS

EPA Sta #	Location	Date Sampled	Analysis By	Aroclor 1016 (mg/kg)*	Aroclor 1254 (mg/kg)*	Aroclor 1242 (mg/kg)*	Total PCB's (mg/kg)*
Sed-1	Trotter's Dump	8/24/76	U.Ga. EPS Lab Svcs Br	50.45 --	78.87 68	-- 33	130 101
Sed-2	Trotter's Dump	8/24/76	U.Ga. EPS Lab Svcs Br	84 --	11.50 ND	-- 30	96 30
Sed-3	Trotter's Dump	8/24/76	U.Ga. EPS Lab Svcs Br	4.5 --	0.99 ND	-- 9.6	5.4 9.6
Sed-4	Trotter's Dump	8/24/76	U.Ga. EPS	0.38	1.49	--	1.9
Sed-5	Midway Dump	8/24/76	U.Ga. EPS Lab Svcs Br	ND ND	ND ND	-- --	ND ND
Sed-6	Easley Landfill	8/24/76	U.Ga. EPS Lab Svcs Br	0.80 0.71	0.55 0.55	-- --	1.4 1.26
Sed-7	Easley Landfill	8/24/76	U.Ga. EPS	0.88	0.29	--	1.2
Sed-8	Easley Landfill	8/24/76	U.Ga. EPS Lab Svcs Br	0.17 0.026	ND 0.030	-- --	0.17 0.056
Sed-9	Easley Landfill	8/24/76	U.Ga. EPS	0.16	ND	--	0.16

* Calculated on a dry weight basis

TABLE 4
LAKE HARTWELL PCB SAMPLING
SANGAMO ELECTRIC COMPANY

EPA Sta #	Location	Date Sampled	Aroclor* 1232	Aroclor* 1242	Aroclor* 1016	Aroclor* 1254	Total PCB's*
SNG-001	Infl. to Upper Pond	8/24-25	--	--	49	1.2	50.2
SNG-002	Effl. from Upper Pond	8/24-25	--	--	19	0.31	19.31
SNG-003	Effl. from Lower Pond	8/24-25	--	--	8.9	1.6	10.5
SNG-004	Sediment - Lower Pond	8/25	--	--	7,982	5,975	13,957
SNG-005	Sediment - Lower Pond	8/25	--	--	1,850	3,321	5,171
SNG-006	Sediment - Upper Pond	8/25	--	--	438	160	598
SNG-007	Septic Tank Sludge	8/26	--	2,600	--	460	3,060
SNG-008	Septic Tank Eff. to Drain tile field	8/26	--	--	960	54	1,014
SNG-009	Old Discharge Ditch (Dry)	8/26	--	ND	--	1.1	1.1
SNG-010	Old Discharge Ditch (Dry)	8/26	--	25	--	ND	25
SNG-011	Drainage Ditch (Dry)	8/26	--	240	--	100	340
SNG-012	Drainage Ditch (Dry)	8/26	--	330	--	190	520
SNG-001	Infl. to Upper Pond	8/25-26	--	--	54	3.9	57.9
SNG-002	Effl. from Upper Pond	8/25-26	--	--	16	0.51	16.51
SNG-003	Effl. from Lower Pond	8/25-26	--	--	8.4	0.44	8.84

TABLE 4
(Continued)

<u>EPA Sta #</u>	<u>Location</u>	<u>Date Sampled</u>	<u>Aroclor* 1232</u>	<u>Aroclor* 1242</u>	<u>Aroclor* 1016</u>	<u>Aroclor* 1254</u>	<u>Total PCB's</u>
SNG-001	Infl to Lower Pond	9/1-2			100	1.2	101.2
SNG-003	Effl from Lower Pond	9/1-2			19	1.9	20.9
SNG-001	Infl to Lower Pond	9/2-3			110	2.8	112.8
SNG-003	Effl from Lower Pond	9/3			30	3.3	33.3
SNG-008	Septic Tank Effl to Drain tile field	9/3			830	72	902
SNG-013	Manhole Upstream from SNG-001	9/2-3			1,800	16	1,816
SNG-014	Manhole Upstream from SNG-001	9/2-3			38	5.9	43.9
SNG-017	Sediment Upper Pond	9/3	--		512	218	730
SNG-018	Sediment Upper Pond	9/3	--		38,000	7,300	45,300
SNG-019	Sediment Upper Pond	9/3	--		19.0	2.9	21.9
SNG-020	Sediment Upper Pond	9/3	--		58.0	3.2	61.2
SNG-021	Sediment Upper Pond	9/3	--		910	210	1,120
SNG-022	Sediment Lower Pond	9/3	--		64	65	129
SNG-023	Sediment Lower Pond	9/3	72,000		--	5,200	77,200
SNG-024	Sediment Lower Pond	9/3	53,000		--	6,100	59,100
SNG-025	Sediment Lower Pond	9/3	7,350		--	810	8,160

* Concentrations: Water - µg/l; Sediments - mg/kg

TABLE 5
LAKE HARTWELL PCB SAMPLING
MISCELLANEOUS SAMPLES

<u>EPA Sta. #</u>	<u>Location</u>	<u>Date Sampled</u>	<u>Aroclor 1016 (ug/l)</u>	<u>Aroclor 1254 (ug/l)</u>	<u>Total PCB's (ug/l)</u>
CU-I	Clemson U. STP (Infl)	8/24-25	ND	<0.3	< 0.3
CU-E	Clemson U. STP (Effl)	8/24-25	ND	ND	ND
CU-I	Clemson U. STP (Infl)	8/25-26	< 1	0.86	0.86
CU-E	Clemson U. STP (Effl)	8/25-26	ND	< 0.5	< 0.5
CL-I	Clemson STP (Infl)	8/24-25	< 1	5.1	5.1
CL-E	Clemson STP (Effl)	8/24-25	ND	ND	ND
CL-I	Clemson STP (Infl)	8/25-26	< 1	0.99	0.99
CL-E	Clemson STP (Effl)	8/25-26	ND	ND	ND
PW-I	Pickens Wolf Crk STP (Infl)	8/24-25	ND	29	29
PW-E	Pickens Wolf Crk STP (Effl)	8/24-25	ND	ND	ND
PW-I	Pickens Wolf Crk STP (Infl)	8/25-26	Lost		
PW-E	Pickens Wolf Crk STP (Effl)	8/25-26	ND	ND	ND
PT-I	Pickens Town Crk STP (Infl)	8/24-25	ND	ND	ND
PT-E	Pickens Town Crk STP (Effl)	8/24-25	ND	ND	ND
PT-I	Pickens Town Crk STP (Infl)	8/25-26	ND	ND	ND
PT-E	Pickens Town Crk STP (Eff)	8/25-26	ND	ND	ND

TABLE 6
LAKE HARTWELL PCB SAMPLING
WATER SAMPLES

<u>EPA Sta #</u>	<u>Location</u>	<u>Date Sampled</u>	<u>1016 (ug/l)</u>	<u>1254 (ug/l)</u>	<u>Total PCB's</u>
Raw Water	Hartwell, GA (Raw)	8/16/76	ND	ND	ND
Fin. Water	Hartwell, GA (Fin.)	8/16/76	ND	ND	ND
Fin. Water	Easley, SC (Fin.)	8/12/76	ND	ND	ND
Fin. Water	Pickens, SC (Fin.)	8/13/76	ND	ND	ND
1-1	Anderson, SC (Raw)	8/25/76	<0.1		<0.1
1-2	Anderson, SC (Fin.)	8/25/76	<0.1		<0.1
2-1	Riegel Textiles (Raw)	8/25/76	ND		ND
2-2	Riegel Textiles (Fin.)	8/25/76	ND		ND
3-1	Clemson U. (Raw)	8/25/76	*		*
3-2	Clemson U. (Fin.)	8/25/76	ND		ND
4-1	DeFore Mills (Raw)	8/25/76	<0.1		<0.1
4-2	DeFore Mills (Fin.)	8/25/76	<0.1		<0.1
5-1	J.P. Stephens (Raw)	8/25/76	<0.1		<0.1
5-2	J.P. Stephens (Fin.)	8/25/76	<0.1		<0.1
6-1	Pendleton Plt (Raw)	8/25/76	ND		
6-2	Pendleton Plt (Fin.)	8/25/76	ND		

* Could not determine presence of PCBs because of high level of interfering compounds

TABLE 7

LAKE HARTWELL PCB SAMPLING
VEGETABLES AT TROTTERS DUMP

Description	Aroclor 1254 Mg/Kg	Aroclor 1016 Mg/Kg	Aroclor 1242 Mg/Kg	Total PCBs Mg/Kg
Bell Pepper	ND	ND	0.093	0.093
Corn	ND	ND	ND	ND
Tomato	ND	ND	ND	ND
Peas	ND	ND	0.302	0.302
Potatoes	0.268	ND	ND	0.268
Okra	<0.10	ND	ND	<0.10

Note: Samples collected on August 24, 1976.

FIGURE 1
SANGAMO SAMPLING STATIONS
PICKENS, SOUTH CAROLINA

August 1976

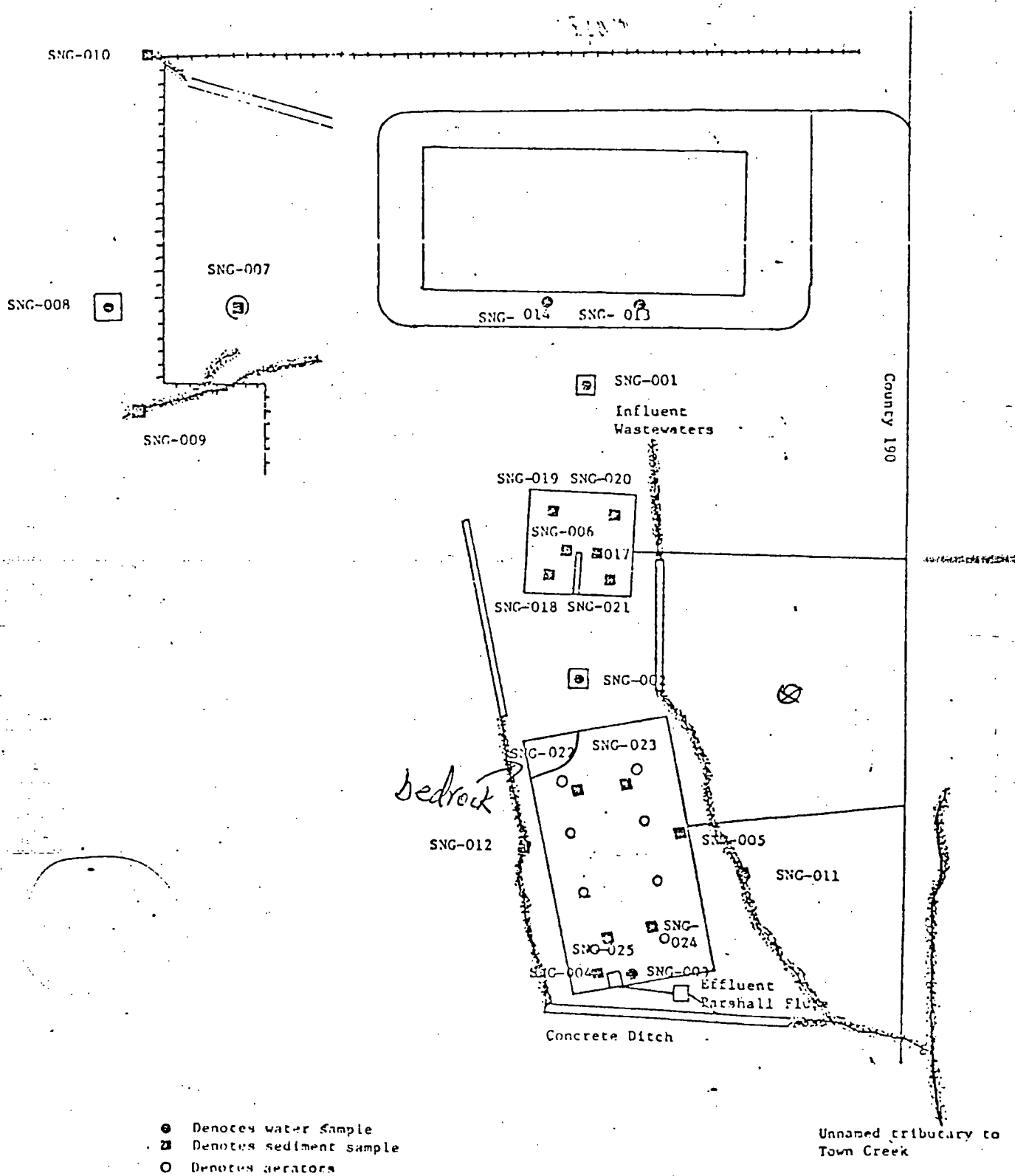


FIGURE 2

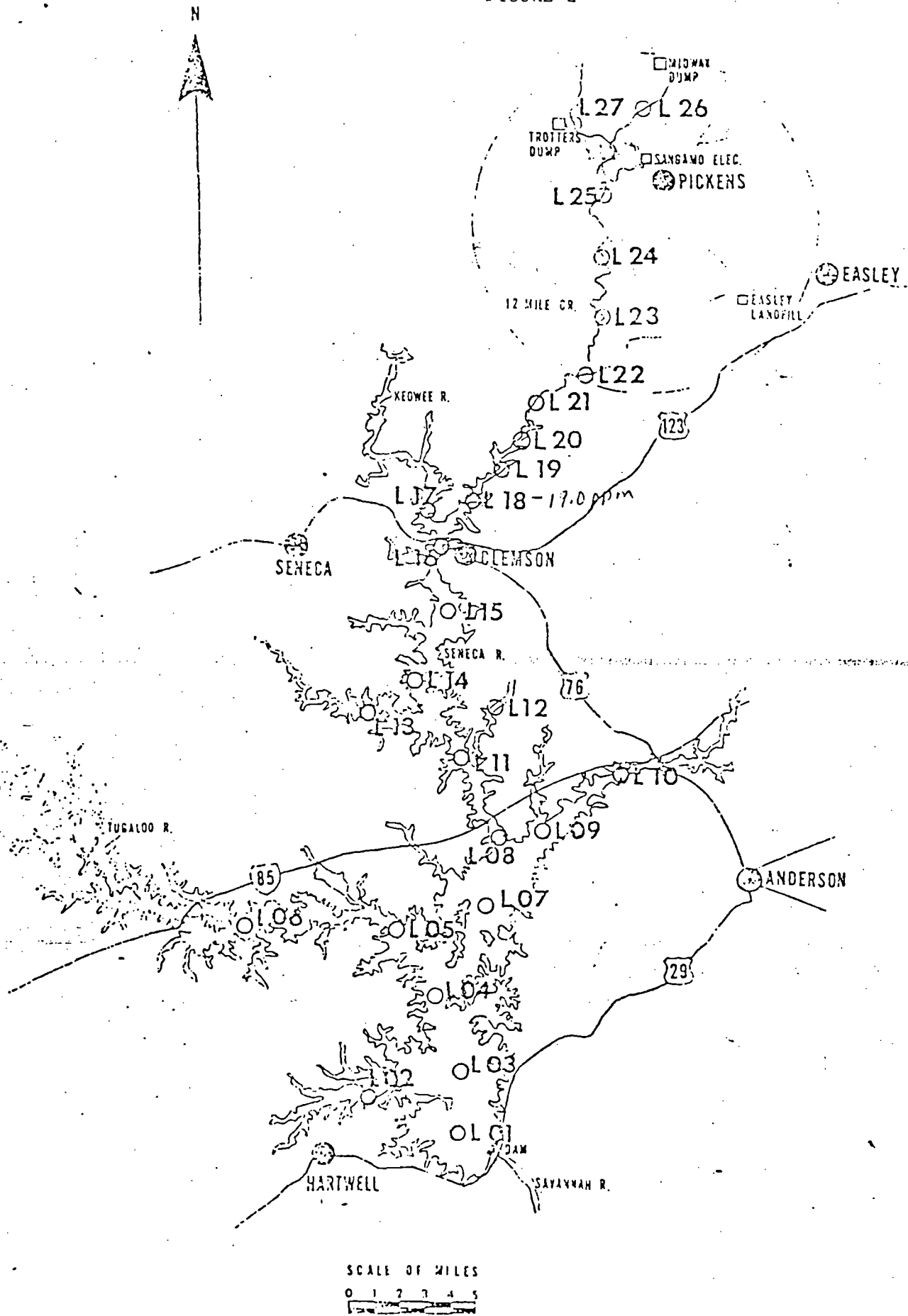
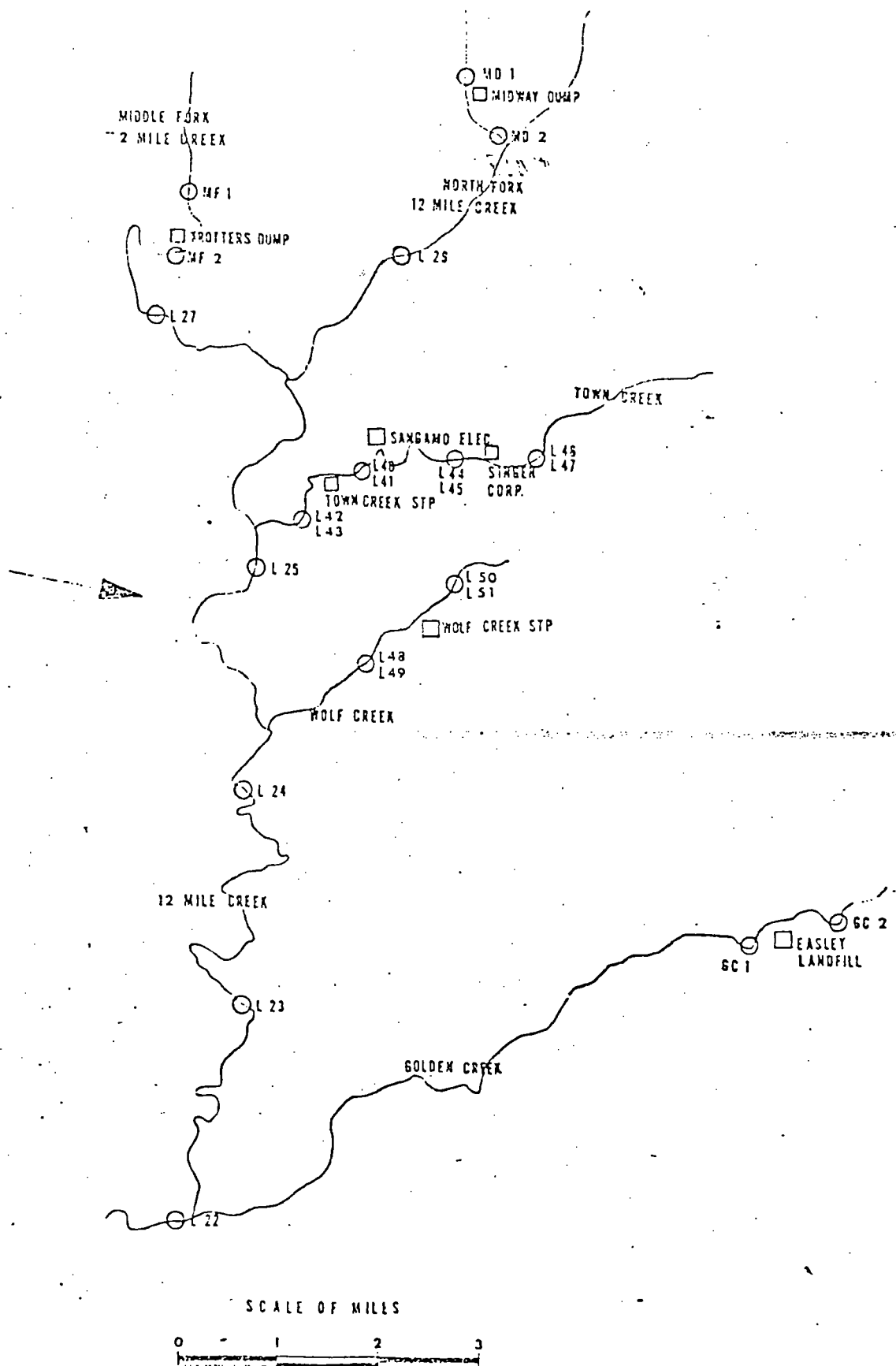
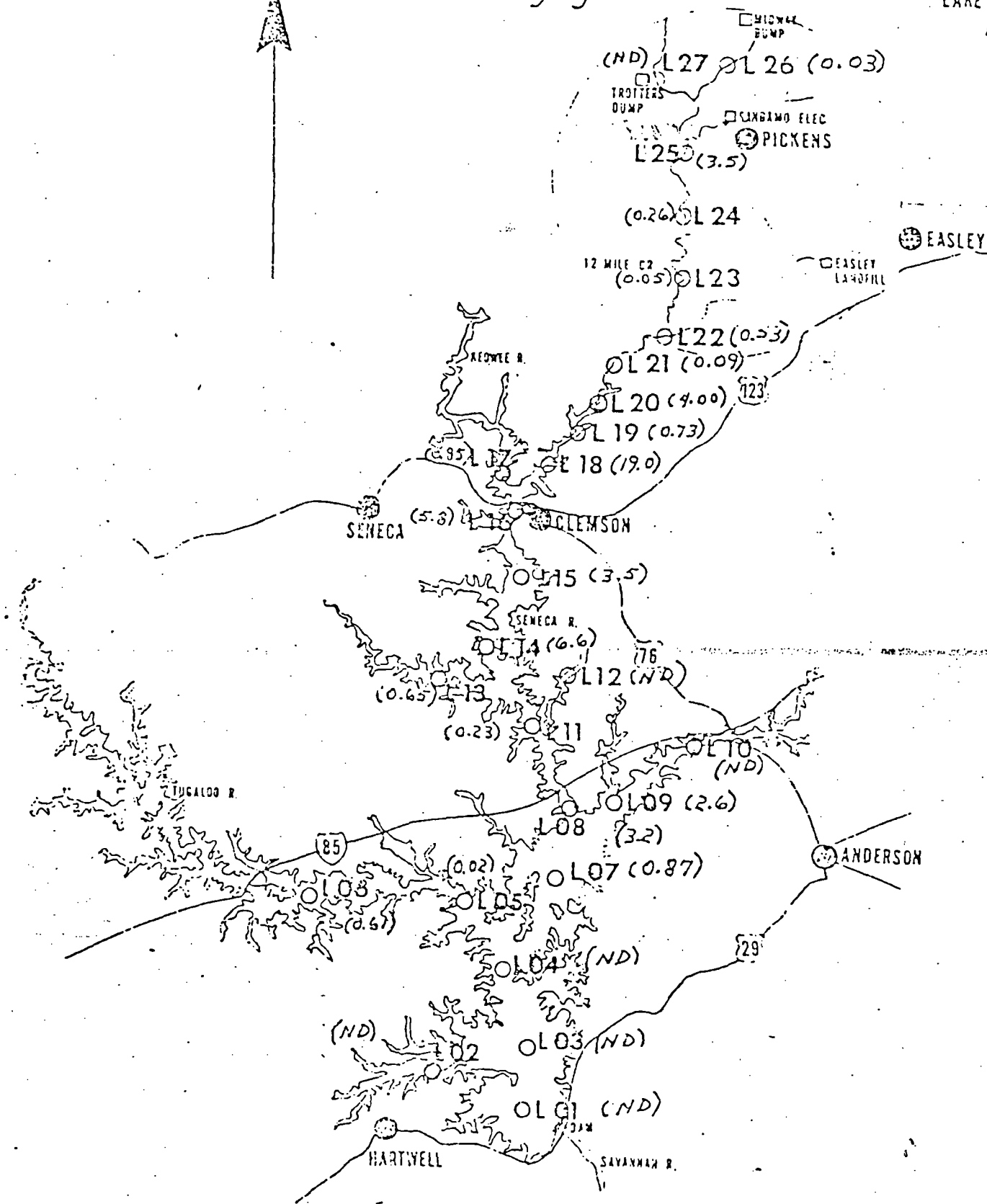


FIGURE 3



SEDIMENTS
PCBs mg/kg

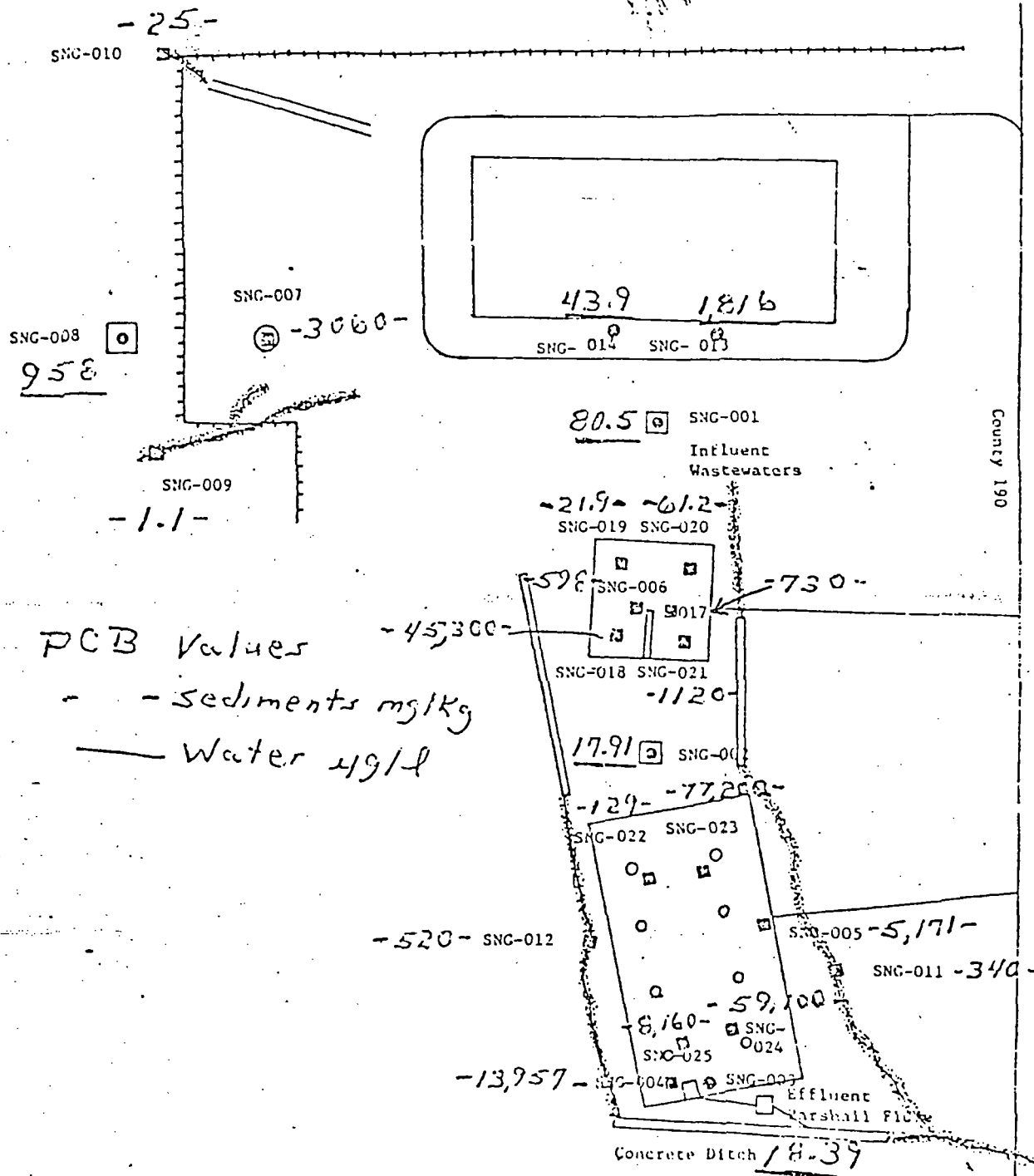
SAMPLING LOCA
PCB STUDY
LAKE HARTWELL VIC
AUGUST, 1976



SCALE OF MILES
0 1 2 3 4 5

SANGAMO SAMPLING STATIONS
PICKENS, SOUTH CAROLINA

August 1976



- Denotes water sample
- Denotes sediment sample
- Denotes aerobic